



**SIMULATION OF BREAKDOWN VOLTAGE ON NMOS TRANSISTOR**

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## ABSTRACT

The simulation of Breakdown Voltage of an NMOS transistor is investigated using Athena/Devedit/Atlas of SILVACO software. The doping profile is modified, resulting in change of breakdown voltage. The doping profiles of the drain drift region, the p channel region and the length of the drift region play an important role in determining the breakdown properties and on state resistances of these devices. The simple model is used in this simulation for determine the doping profile and drive-in diffusion at the drain that give impact to the breakdown voltage. The dependence of breakdown voltage is studied based on device and process simulation. The possible location of breakdown voltage is at  $n^+$ -p junction. The profile doping is change based on the implant dose due to raising the breakdown, where is implantation dose proportional to implantation time. Current-voltage (I-V) characteristics curves and structure that show the impact gent rate of device were obtained from the simulation. The structure has been simulated using a process simulator and device characteristics were obtained using a device simulator. The breakdown voltage in the range of 8.9V to 9.156V has been obtained from different drain implant dose and drain drive-in time.

***Keywords-component; breakdown voltage; channel length; doping profile; MOSFET;***

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# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND

The standard MOSFET structure consists of a metal gate, a layer insulating oxide and a silicon substrate and the source and drain is general structure that is lightly doped p-type substrate and it usually heavily doped with n-type semiconductor that have been embedded. A metal (or poly-crystalline) gate covers the region between source and drain, but is separated from the semiconductor by the gate oxide. Nowadays, the oxide thicknesses are used is 1.5nm where it is like one fifty-thousandth of the width of human air. In 2007 less than 1nm is necessary and appropriate only 4 atomic layers [1, 2]. In this oxide thickness, quantum mechanical tunneling current pass through the oxide. At these thicknesses, quantum mechanical tunneling becomes restrained. From the MOSFET structure show below, the symbol  $n^+$  is used to drop off this heavy doping. Figure 1.1 shows the idealized MOSFET structure and circuit symbol of an n-MOSFET. Besides that, MOSFET is transistor used for amplifying or switching electronic signal. MOSFET divided into four terminal devices with source (S), gate (G), drain (D), and body (B) terminal.

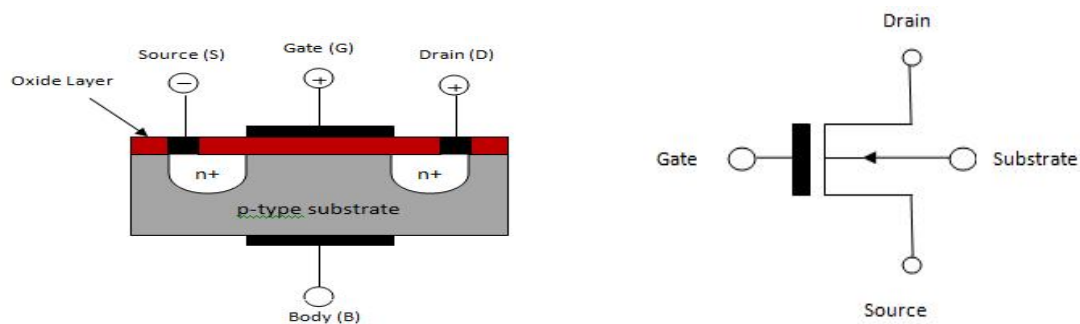


Figure 1.1: Idealized MOSFET structure and circuit symbol of an NMOS